

## SEQUENCE LISTING

<110> Chapple, Clinton

Franke, Rochus

Ruegger, Maxwell

<120> Genes Encoding P-Coumarate 3-Hydroxylase (C3H) and Methods of Use

<130> N1422-005

<150> US 60/225554

<151> 2000-08-16

<160> 7

<170> PatentIn version 3.0

<210> 1

<211> 1527

<212> DNA

<213> *Arabidopsis thaliana*

<400> 1  
atgtcgtggt ttctaatagc ggtggcgaca atcgccgccg tcgtatccta caagctaadc 60  
caacggctaa gatacaagtt cccaccaggc ccaagcccca agccgatcgt cggtaacctc 120  
tacgacataa aaccggtccg gttcagatgt tactacgagt gggctcaatc ttatggacca 180  
atcatatcgg tctggatcgg ttcaattcta aacgtggtcg tatctagcgc cgagctagca 240  
aaagaagttc tgaaagaaca cgaccagaaa ctgcgccgacc ggcaccggaa cagatcgacg 300

gaagcattta gccgcaacgg tcaggatctt atatgggccc attatgggcc tcattacgtg 360  
 aaggtgagaa aagtttgac gcttgagctc ttcacaccga aacgactcga gtctctcaga 420  
 cctatccgtg aagatgaagt caccgccatg gttgaatccg tcttcagaga ctgtaacctt 480  
 cctgaaaaca gagcaaaagg ttacaaactg aggaagtact taggagcggg tgcgttcaac 540  
 aacataacgc ggctagcctt tgggaagcgt tttatgaacg ctgaagggtg tgtggacgag 600  
 caagggcttg agttcaaggc catagtatcc aacggctctga agctaggtgc ttcactgtca 660  
 atagctgaac acatcccgtg gctcaggtgg atgtttccgg ctgatgagaa ggcgtttgct 720  
 gagcacgggg ctgcgtcgtga ccgcctcact cgagctatca tggaggagca tactttggcc 780  
 cgtcaaaagt ctagtggagc gaaacagcat ttcgttgatg cgttgctaac gttgaaggat 840  
 cagtatgac ttagtgagga tactatcatt ggtcttctat gggatatgat cacggcaggg 900  
 atggacacga cagcgataac agcggaatgg gcgatggcgg aaatgatcaa gaatccaaga 960  
 gtgcaaaaa aagtgcaaga agagtccgac agagtgggtg gacttgaccg gatcttaacc 1020  
 gaggcagatt tctcccgtt accttacttg caatgcgtgg tgaaagagtc attcaggctg 1080  
 catcctccaa cgctctaat gctacctcac cgaagcaacg cagatgtcaa gatcggaggc 1140  
 tatgatattc ccaaaggatc aaacgttcat gtgaatgtgt gggctgtggc tagagaccg 1200  
 gctgtatgga aaaatccatt tgagtttaga ccagagagat tcttggaaga agatgttgac 1260  
 atgaagggtc atgatttttag gctgcttccg tttggagctg gaagacgggt ttgtcccgg 1320  
 gcacaacttg gtatcaattt ggtaacttcg atgatgagtc atttgcttca ccattttgtt 1380  
 tggacacctc ctcaagggac taaaccggag gagattgaca tgtctgaaaa ccttggaactc 1440  
 gttacttaca tgcgtacccc tgtgcaagcg gttgcaacgc ctcggttgcc ttcggatctg 1500  
 taaaaacgcg tgccttacga tatgtaa 1527

<210> 2

<211> 1527

<212> DNA

<213> *Arabidopsis thaliana*

<400> 2

atgctgtggg ttctaatagc ggtggcgaca atcgccgccg tcgtatccta caagctaac 60

caacggctaa gatacaagtt cccaccaggc ccaagcccca agccgatcgt cggtaacctc 120  
 tacgacataa aaccggtccg gttcagatgt tactacgagt gggctcaatc ttatggacca 180  
 atcatatcgg tctggatcgg ttcaattcta aacgtggtcg tatctagcgc cgagctagca 240  
 aaagaagttc tgaaagaaca cgaccagaaa ctgcgcgacc ggcaccggaa cagatcgacg 300  
 gaagcattta gccgcaacgg tcaggatctt atatgggccc attatgggcc tcattacgtg 360  
 aaggtgagaa aagtttgcac gcttgagctc ttcacaccga aacgactcga gtctctcaga 420  
 cctatccgtg aagatgaagt caccgccatg gttgaatccg tcttcagaga ctgtaacctt 480  
 cctgaaaaca gagcaaaagg tttacaactg aggaagtact taggagcggg tgcgttcaac 540  
 aacataacgc ggctagcctt tgggaagcgt tttatgaacg ctgaagggtg tgtggacgag 600  
 caagggcttg agttcaaggc catagtatcc aacggtctga agctaggtgc ttcactgtca 660  
 atagctgaac acatcccgtg gctcaggtgg atgtttccgg ctgatgagaa ggcgtttgct 720  
 gagcacgggg ctgcgtcgtg ccgcctcact cgagctatca tggaggagca tactttggcc 780  
 cgtcaaaagt ctagtggagc gaaacagcat ttcgttgatg cgttgctaac gttgaaggat 840  
 cagtatgatc ttagtgagga tactatcatt ggtcttctat gggatatgat cacggcaggg 900  
 atggacacga cagcgataac agcggaatgg gcgatggcgg aatgatcaa gaatccaaga 960  
 gtgcaacaaa aagtgcaga agagtccgac agagtgggtg gacttgaccg gatcttaacc 1020  
 gaggcagatt tctcccgtt accttacttg caatgcgtgg tgaaagagtc attcaggctg 1080  
 catcctccaa cgcctctaata gctacctcac cgaagcaacg cagatgtcaa gatcggaggc 1140  
 tatgatattc ccaaaggatc aaacgttcat gtgaatgtgt gggctgtggc tagagacccg 1200  
 gctgtatgga aaaatccatt tgagtttaga ccagagagat tcttggaaga agatgttgac 1260  
 atgaagggtc atgatttttag gctgcttccg tttggagctg gaagacgggt ttgtcccgtt 1320  
 gcacaacttg atatcaattt ggtaacttcg atgatgagtc atttgcttca ccattttgtt 1380  
 tggacacctc ctcaaggagac taaaccggag gagattgaca tgtctgaaaa ccctggactc 1440  
 gttacttaca tgcgtacccc tgtgcaagcg gttgcaacgc ctcggttgcc ttcggatctg 1500  
 taaaaacgcg tgccttacga tatgtaa 1527

<210> 3

<211> 1549

<212> DNA

<213> *Arabidopsis thaliana*

<400> 3

gcaaggatcc atgtcgtggt ttctaatagc ggtggcgaca atcgccgccg tcgtatccta	60
caagctaata caacggctaa gatacaagtt cccaccaggc ccaagcccca agccgatcgt	120
cggtaacctc tacgacataa aaccggtcgg gttcagatgt tactacgagt gggctcaatc	180
ttatggacca atcatatcgg tctggatcgg ttcaattcta aacgtggtcg tatctagcgc	240
cgagctagca aaagaagttc tgaaagaaca cgaccagaaa ctcgccgacc ggcaccggaa	300
cagatcgacg gaagcattta gccgcaacgg tcaggatctt atatgggccg attatgggcc	360
tcattacgtg aaggtgagaa aagtttgcac gcttgagctc ttcacaccga aacgactcga	420
gtctctcaga cctatccgtg aagatgaagt caccgccatg gttgaatccg tcttcagaga	480
ctgtaacctt cctgaaaaca gagcaaaagg tttacaactg aggaagtact taggagcggg	540
tgcgttcaac aacataacgc ggctagcctt tgggaagcgt tttatgaacg ctgaagggtg	600
tgtggacgag caagggcttg agttcaaggc catagtatcc aacgggtctga agctaggtgc	660
ttcactgtca atagctgaac acatcccggt gctcagggtg atgtttccgg ctgatgagaa	720
ggcgtttgct gagcacgggg ctcgtcgtga ccgcctcact cgagctatca tggaggagca	780
tactttggcc cgtcaaaagt ctagtggagc gaaacagcat ttcgttgatg cgttgctaac	840
gttgaaggat cagtatgac ttagtgagga tactatcatt ggtcttctat gggatatgat	900
cacggcaggg atggacacga cagcgataac agcggaatgg gcgatggcgg aatgatcaa	960
gaatccaaga gtgcaacaaa aagtgcaaga agagtgcac agagtgggtg gacttgaccg	1020
gatcttaacc gaggcagatt tctcccgtt accttacttg caatgcgtgg tgaaagagtc	1080
attcaggctg catcctccaa cgcctctaata gctacctcac cgaagcaacg cagatgtcaa	1140
gatcggaggg tatgatattc ccaaaggatc aaacgttcat gtgaatgtgt gggctgtggc	1200
tagagaccgg gctgtatgga aaaatccatt tgagtttaga ccagagagat tcttggaaga	1260
agatgttgac atgaagggtc atgatttttag gctgcttccg tttggagctg gaagacgggt	1320
ttgtcccggg gcacaacttg gtatcaattt ggtaacttcg atgatgagtc atttgcttca	1380
ccattttgtt tggacacctc ctcaaggag taaaccggag gagattgaca tgtctgaaaa	1440

ccctggactc gttacttaca tgcgtacccc tgtgcaagcg gttgcaacgc ctcggttgcc 1500  
 ttcggatctg tacaaaacgcg tgccttacga tatgtaaatg aattcctga 1549

<210> 4

<211> 508

<212> PRT

<213> Arabidopsis thaliana

<400> 4

Met Ser Trp Phe Leu Ile Ala Val Ala Thr Ile Ala Ala Val Val Ser  
 1 5 10 15  
 Tyr Lys Leu Ile Gln Arg Leu Arg Tyr Lys Phe Pro Pro Gly Pro Ser  
 20 25 30  
 Pro Lys Pro Ile Val Gly Asn Leu Tyr Asp Ile Lys Pro Val Arg Phe  
 35 40 45  
 Arg Cys Tyr Tyr Glu Trp Ala Gln Ser Tyr Gly Pro Ile Ile Ser Val  
 50 55 60  
 Trp Ile Gly Ser Ile Leu Asn Val Val Val Ser Ser Ala Glu Leu Ala  
 65 70 75 80  
 Lys Glu Val Leu Lys Glu His Asp Gln Lys Leu Ala Asp Arg His Arg  
 85 90 95  
 Asn Arg Ser Thr Glu Ala Phe Ser Arg Asn Gly Gln Asp Leu Ile Trp  
 100 105 110  
 Ala Asp Tyr Gly Pro His Tyr Val Lys Val Arg Lys Val Cys Thr Leu  
 115 120 125  
 Glu Leu Phe Thr Pro Lys Arg Leu Glu Ser Leu Arg Pro Ile Arg Glu  
 130 135 140  
 Asp Glu Val Thr Ala Met Val Glu Ser Val Phe Arg Asp Cys Asn Leu  
 145 150 155 160  
 Pro Glu Asn Arg Ala Lys Gly Leu Gln Leu Arg Lys Tyr Leu Gly Ala  
 165 170 175  
 Val Ala Phe Asn Asn Ile Thr Arg Leu Ala Phe Gly Lys Arg Phe Met  
 180 185 190  
 Asn Ala Glu Gly Val Val Asp Glu Gln Gly Leu Glu Phe Lys Ala Ile  
 195 200 205

Val	Ser	Asn	Gly	Leu	Lys	Leu	Gly	Ala	Ser	Leu	Ser	Ile	Ala	Glu	His	210	215	220	
Ile	Pro	Trp	Leu	Arg	Trp	Met	Phe	Pro	Ala	Asp	Glu	Lys	Ala	Phe	Ala	225	230	235	240
Glu	His	Gly	Ala	Arg	Arg	Asp	Arg	Leu	Thr	Arg	Ala	Ile	Met	Glu	Glu	245	250	255	
His	Thr	Leu	Ala	Arg	Gln	Lys	Ser	Ser	Gly	Ala	Lys	Gln	His	Phe	Val	260	265	270	
Asp	Ala	Leu	Leu	Thr	Leu	Lys	Asp	Gln	Tyr	Asp	Leu	Ser	Glu	Asp	Thr	275	280	285	
Ile	Ile	Gly	Leu	Leu	Trp	Asp	Met	Ile	Thr	Ala	Gly	Met	Asp	Thr	Thr	290	295	300	
Ala	Ile	Thr	Ala	Glu	Trp	Ala	Met	Ala	Glu	Met	Ile	Lys	Asn	Pro	Arg	305	310	315	320
Val	Gln	Gln	Lys	Val	Gln	Glu	Glu	Phe	Asp	Arg	Val	Val	Gly	Leu	Asp	325	330	335	
Arg	Ile	Leu	Thr	Glu	Ala	Asp	Phe	Ser	Arg	Leu	Pro	Tyr	Leu	Gln	Cys	340	345	350	
Val	Val	Lys	Glu	Ser	Phe	Arg	Leu	His	Pro	Pro	Thr	Pro	Leu	Met	Leu	355	360	365	
Pro	His	Arg	Ser	Asn	Ala	Asp	Val	Lys	Ile	Gly	Gly	Tyr	Asp	Ile	Pro	370	375	380	
Lys	Gly	Ser	Asn	Val	His	Val	Asn	Val	Trp	Ala	Val	Ala	Arg	Asp	Pro	385	390	395	400
Ala	Val	Trp	Lys	Asn	Pro	Phe	Glu	Phe	Arg	Pro	Glu	Arg	Phe	Leu	Glu	405	410	415	
Glu	Asp	Val	Asp	Met	Lys	Gly	His	Asp	Phe	Arg	Leu	Leu	Pro	Phe	Gly	420	425	430	
Ala	Gly	Arg	Arg	Val	Cys	Pro	Gly	Ala	Gln	Leu	Gly	Ile	Asn	Leu	Val	435	440	445	
Thr	Ser	Met	Met	Ser	His	Leu	Leu	His	His	Phe	Val	Trp	Thr	Pro	Pro	450	455	460	
Gln	Gly	Thr	Lys	Pro	Glu	Glu	Ile	Asp	Met	Ser	Glu	Asn	Pro	Gly	Leu	465	470	475	480
Val	Thr	Tyr	Met	Arg	Thr	Pro	Val	Gln	Ala	Val	Ala	Thr	Pro	Arg	Leu	485	490	495	

Pro Ser Asp Leu Tyr Lys Arg Val Pro Tyr Asp Met  
500 505

<210> 5

<211> 508

<212> PRT

<213> Arabidopsis thaliana

<400> 5

Met Ser Trp Phe Leu Ile Ala Val Ala Thr Ile Ala Ala Val Val Ser  
1 5 10 15

Tyr Lys Leu Ile Gln Arg Leu Arg Tyr Lys Phe Pro Pro Gly Pro Ser  
20 25 30

Pro Lys Pro Ile Val Gly Asn Leu Tyr Asp Ile Lys Pro Val Arg Phe  
35 40 45

Arg Cys Tyr Tyr Glu Trp Ala Gln Ser Tyr Gly Pro Ile Ile Ser Val  
50 55 60

Trp Ile Gly Ser Ile Leu Asn Val Val Val Ser Ser Ala Glu Leu Ala  
65 70 75 80

Lys Glu Val Leu Lys Glu His Asp Gln Lys Leu Ala Asp Arg His Arg  
85 90 95

Asn Arg Ser Thr Glu Ala Phe Ser Arg Asn Gly Gln Asp Leu Ile Trp  
100 105 110

Ala Asp Tyr Gly Pro His Tyr Val Lys Val Arg Lys Val Cys Thr Leu  
115 120 125

Glu Leu Phe Thr Pro Lys Arg Leu Glu Ser Leu Arg Pro Ile Arg Glu  
130 135 140

Asp Glu Val Thr Ala Met Val Glu Ser Val Phe Arg Asp Cys Asn Leu  
145 150 155 160

Pro Glu Asn Arg Ala Lys Gly Leu Gln Leu Arg Lys Tyr Leu Gly Ala  
165 170 175

Val Ala Phe Asn Asn Ile Thr Arg Leu Ala Phe Gly Lys Arg Phe Met  
180 185 190

Asn Ala Glu Gly Val Val Asp Glu Gln Gly Leu Glu Phe Lys Ala Ile  
195 200 205

Val	Ser	Asn	Gly	Leu	Lys	Leu	Gly	Ala	Ser	Leu	Ser	Ile	Ala	Glu	His	210	215	220	
Ile	Pro	Trp	Leu	Arg	Trp	Met	Phe	Pro	Ala	Asp	Glu	Lys	Ala	Phe	Ala	225	230	235	240
Glu	His	Gly	Ala	Arg	Arg	Asp	Arg	Leu	Thr	Arg	Ala	Ile	Met	Glu	Glu	245	250	255	
His	Thr	Leu	Ala	Arg	Gln	Lys	Ser	Ser	Gly	Ala	Lys	Gln	His	Phe	Val	260	265	270	
Asp	Ala	Leu	Leu	Thr	Leu	Lys	Asp	Gln	Tyr	Asp	Leu	Ser	Glu	Asp	Thr	275	280	285	
Ile	Ile	Gly	Leu	Leu	Trp	Asp	Met	Ile	Thr	Ala	Gly	Met	Asp	Thr	Thr	290	295	300	
Ala	Ile	Thr	Ala	Glu	Trp	Ala	Met	Ala	Glu	Met	Ile	Lys	Asn	Pro	Arg	305	310	315	320
Val	Gln	Gln	Lys	Val	Gln	Glu	Glu	Phe	Asp	Arg	Val	Val	Gly	Leu	Asp	325	330	335	
Arg	Ile	Leu	Thr	Glu	Ala	Asp	Phe	Ser	Arg	Leu	Pro	Tyr	Leu	Gln	Cys	340	345	350	
Val	Val	Lys	Glu	Ser	Phe	Arg	Leu	His	Pro	Pro	Thr	Pro	Leu	Met	Leu	355	360	365	
Pro	His	Arg	Ser	Asn	Ala	Asp	Val	Lys	Ile	Gly	Gly	Tyr	Asp	Ile	Pro	370	375	380	
Lys	Gly	Ser	Asn	Val	His	Val	Asn	Val	Trp	Ala	Val	Ala	Arg	Asp	Pro	385	390	395	400
Ala	Val	Trp	Lys	Asn	Pro	Phe	Glu	Phe	Arg	Pro	Glu	Arg	Phe	Leu	Glu	405	410	415	
Glu	Asp	Val	Asp	Met	Lys	Gly	His	Asp	Phe	Arg	Leu	Leu	Pro	Phe	Gly	420	425	430	
Ala	Gly	Arg	Arg	Val	Cys	Pro	Gly	Ala	Gln	Leu	Asp	Ile	Asn	Leu	Val	435	440	445	
Thr	Ser	Met	Met	Ser	His	Leu	Leu	His	His	Phe	Val	Trp	Thr	Pro	Pro	450	455	460	
Gln	Gly	Thr	Lys	Pro	Glu	Glu	Ile	Asp	Met	Ser	Glu	Asn	Pro	Gly	Leu	465	470	475	480
Val	Thr	Tyr	Met	Arg	Thr	Pro	Val	Gln	Ala	Val	Ala	Thr	Pro	Arg	Leu	485	490	495	



Pro Ser Asp Leu Tyr Lys Arg Val Pro Tyr Asp Met  
 500 505

<210> 6

<211> 477

<212> PRT

<213> Arabidopsis thaliana

<400> 6

Ser Pro Lys Pro Ile Val Gly Asn Leu Tyr Asp Ile Lys Pro Val Arg  
 1 5 10 15

Phe Arg Cys Tyr Tyr Glu Trp Ala Gln Ser Tyr Gly Pro Ile Ile Ser  
 20 25 30

Val Trp Ile Gly Ser Ile Leu Asn Val Val Val Ser Ser Ala Glu Leu  
 35 40 45

Ala Lys Glu Val Leu Lys Glu His Asp Gln Lys Leu Ala Asp Arg His  
 50 55 60

Arg Asn Arg Ser Thr Glu Ala Phe Ser Arg Asn Gly Gln Asp Leu Ile  
 65 70 75 80

Trp Ala Asp Tyr Gly Pro His Tyr Val Lys Val Arg Lys Val Cys Thr  
 85 90 95

Leu Glu Leu Phe Thr Pro Lys Arg Leu Glu Ser Leu Arg Pro Ile Arg  
 100 105 110

Glu Asp Glu Val Thr Ala Met Val Glu Ser Val Phe Arg Asp Cys Asn  
 115 120 125

Leu Pro Glu Asn Arg Ala Lys Gly Leu Gln Leu Arg Lys Tyr Leu Gly  
 130 135 140

Ala Val Ala Phe Asn Asn Ile Thr Arg Leu Ala Phe Gly Lys Arg Phe  
 145 150 155 160

Met Asn Ala Glu Gly Val Val Asp Glu Gln Gly Leu Glu Phe Lys Ala  
 165 170 175

Ile Val Ser Asn Gly Leu Lys Leu Gly Ala Ser Leu Ser Ile Ala Glu  
 180 185 190

His Ile Pro Trp Leu Arg Trp Met Phe Pro Ala Asp Glu Lys Ala Phe  
 195 200 205

Ala Glu His Gly Ala Arg Arg Asp Arg Leu Thr Arg Ala Ile Met Glu  
 210 215 220  
 Glu His Thr Leu Ala Arg Gln Lys Ser Ser Gly Ala Lys Gln His Phe  
 225 230 235 240  
 Val Asp Ala Leu Leu Thr Leu Lys Asp Gln Tyr Asp Leu Ser Glu Asp  
 245 250 255  
 Thr Ile Ile Gly Leu Leu Trp Asp Met Ile Thr Ala Gly Met Asp Thr  
 260 265 270  
 Thr Ala Ile Thr Ala Glu Trp Ala Met Ala Glu Met Ile Lys Asn Pro  
 275 280 285  
 Arg Val Gln Gln Lys Val Gln Glu Glu Phe Asp Arg Val Val Gly Leu  
 290 295 300  
 Asp Arg Ile Leu Thr Glu Ala Asp Phe Ser Arg Leu Pro Tyr Leu Gln  
 305 310 315 320  
 Cys Val Val Lys Glu Ser Phe Arg Leu His Pro Pro Thr Pro Leu Met  
 325 330 335  
 Leu Pro His Arg Ser Asn Ala Asp Val Lys Ile Gly Gly Tyr Asp Ile  
 340 345 350  
 Pro Lys Gly Ser Asn Val His Val Asn Val Trp Ala Val Ala Arg Asp  
 355 360 365  
 Pro Ala Val Trp Lys Asn Pro Phe Glu Phe Arg Pro Glu Arg Phe Leu  
 370 375 380  
 Glu Glu Asp Val Asp Met Lys Gly His Asp Phe Arg Leu Leu Pro Phe  
 385 390 395 400  
 Gly Ala Gly Arg Arg Val Cys Pro Gly Ala Gln Leu Gly Ile Asn Leu  
 405 410 415  
 Val Thr Ser Met Met Ser His Leu Leu His His Phe Val Trp Thr Pro  
 420 425 430  
 Pro Gln Gly Thr Lys Pro Glu Glu Ile Asp Met Ser Glu Asn Pro Gly  
 435 440 445  
 Leu Val Thr Tyr Met Arg Thr Pro Val Gln Ala Val Ala Thr Pro Arg  
 450 455 460  
 Leu Pro Ser Asp Leu Tyr Lys Arg Val Pro Tyr Asp Met  
 465 470 475

&lt;210&gt; 7

&lt;211&gt; 477

&lt;212&gt; PRT

&lt;213&gt; Arabidopsis thaliana

&lt;400&gt; 7

Ser	Pro	Lys	Pro	Ile	Val	Gly	Asn	Leu	Tyr	Asp	Ile	Lys	Pro	Val	Arg	1	5	10	15
Phe	Arg	Cys	Tyr	Tyr	Glu	Trp	Ala	Gln	Ser	Tyr	Gly	Pro	Ile	Ile	Ser	20	25	30	
Val	Trp	Ile	Gly	Ser	Ile	Leu	Asn	Val	Val	Val	Ser	Ser	Ala	Glu	Leu	35	40	45	
Ala	Lys	Glu	Val	Leu	Lys	Glu	His	Asp	Gln	Lys	Leu	Ala	Asp	Arg	His	50	55	60	
Arg	Asn	Arg	Ser	Thr	Glu	Ala	Phe	Ser	Arg	Asn	Gly	Gln	Asp	Leu	Ile	65	70	75	80
Trp	Ala	Asp	Tyr	Gly	Pro	His	Tyr	Val	Lys	Val	Arg	Lys	Val	Cys	Thr	85	90	95	
Leu	Glu	Leu	Phe	Thr	Pro	Lys	Arg	Leu	Glu	Ser	Leu	Arg	Pro	Ile	Arg	100	105	110	
Glu	Asp	Glu	Val	Thr	Ala	Met	Val	Glu	Ser	Val	Phe	Arg	Asp	Cys	Asn	115	120	125	
Leu	Pro	Glu	Asn	Arg	Ala	Lys	Gly	Leu	Gln	Leu	Arg	Lys	Tyr	Leu	Gly	130	135	140	
Ala	Val	Ala	Phe	Asn	Asn	Ile	Thr	Arg	Leu	Ala	Phe	Gly	Lys	Arg	Phe	145	150	155	160
Met	Asn	Ala	Glu	Gly	Val	Val	Asp	Glu	Gln	Gly	Leu	Glu	Phe	Lys	Ala	165	170	175	
Ile	Val	Ser	Asn	Gly	Leu	Lys	Leu	Gly	Ala	Ser	Leu	Ser	Ile	Ala	Glu	180	185	190	
His	Ile	Pro	Trp	Leu	Arg	Trp	Met	Phe	Pro	Ala	Asp	Glu	Lys	Ala	Phe	195	200	205	
Ala	Glu	His	Gly	Ala	Arg	Arg	Asp	Arg	Leu	Thr	Arg	Ala	Ile	Met	Glu	210	215	220	
Glu	His	Thr	Leu	Ala	Arg	Gln	Lys	Ser	Ser	Gly	Ala	Lys	Gln	His	Phe	225	230	235	240
Val	Asp	Ala	Leu	Leu	Thr	Leu	Lys	Asp	Gln	Tyr	Asp	Leu	Ser	Glu	Asp	245	250	255	

Thr Ile Ile Gly Leu Leu Trp Asp Met Ile Thr Ala Gly Met Asp Thr  
 260 265 270

Thr Ala Ile Thr Ala Glu Trp Ala Met Ala Glu Met Ile Lys Asn Pro  
 275 280 285

Arg Val Gln Gln Lys Val Gln Glu Glu Phe Asp Arg Val Val Gly Leu  
 290 295 300

Asp Arg Ile Leu Thr Glu Ala Asp Phe Ser Arg Leu Pro Tyr Leu Gln  
 305 310 315 320

Cys Val Val Lys Glu Ser Phe Arg Leu His Pro Pro Thr Pro Leu Met  
 325 330 335

Leu Pro His Arg Ser Asn Ala Asp Val Lys Ile Gly Gly Tyr Asp Ile  
 340 345 350

Pro Lys Gly Ser Asn Val His Val Asn Val Trp Ala Val Ala Arg Asp  
 355 360 365

Pro Ala Val Trp Lys Asn Pro Phe Glu Phe Arg Pro Glu Arg Phe Leu  
 370 375 380

Glu Glu Asp Val Asp Met Lys Gly His Asp Phe Arg Leu Leu Pro Phe  
 385 390 395 400

Gly Ala Gly Arg Arg Val Cys Pro Gly Ala Gln Leu Asp Ile Asn Leu  
 405 410 415

Val Thr Ser Met Met Ser His Leu Leu His His Phe Val Trp Thr Pro  
 420 425 430

Pro Gln Gly Thr Lys Pro Glu Glu Ile Asp Met Ser Glu Asn Pro Gly  
 435 440 445

Leu Val Thr Tyr Met Arg Thr Pro Val Gln Ala Val Ala Thr Pro Arg  
 450 455 460

Leu Pro Ser Asp Leu Tyr Lys Arg Val Pro Tyr Asp Met  
 465 470 475